

## Pupae of Japanese *Amphipyra* moths (Lepidoptera, Noctuidae)

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**Abstract** Pupae of seven species of Japanese *Amphipyra*, *A. pyramidea*, *A. monolitha*, *A. livida*, *A. tripartita*, *A. schrenckii*, *A. erebina* and *A. sp.* (= *subrigua* auct.) are described with short biological notes.

**Key words** *Amphipyra*, pupa, morphology, cremaster, hooked setae.

In the Tokai district, adults of *Amphipyra* moths appear in early summer and gather at aestivating sites such as panels of wooden buildings and crevices of dead trees. After aestivating, females mate and lay eggs in late summer in *A. erebina* and in autumn in other species. Larvae from overwintering eggs grow to the last instar and pupate in cocoons about a month before emergence. Almost all the species are polyphagous on various kinds of trees and herbs except *A. sp.* (= *subrigua* auct.) which is known to be confined to *Buxus microphylla* Sieb. et Zucc. (Owada & Yamamoto, 1983). As far as I know, morphology and ethology of pupae of *Amphipyra* are only a little recorded until now (Khotjko, 1968). Based on experience from rearing, it is suggested that the larvae, leaving the host plants, pupate on or below the surface of the ground. This paper deals with pupal morphology of seven Japanese *Amphipyra* species with biological notes on pupation.

### General morphology of pupa in *Amphipyra* species

Fusiform; relatively large (16-29 mm in length); stout; reddish to blackish brown. F1, Af1 and Af2 setae present. Frontal part of adfrontal suture and labral suture indistinct; labial palpus large; mandible scarcely visible; caudal end of suture defining eye-piece reaching prothoracic leg; antenna slender, reaching before tip of mesothoracic leg; maxilla extending slightly before apex of wing, cephalic margin gently oblique; suture between pro- and mesothorax touching antenna at slightly caudad of suture restricting basal margin of mesothoracic leg; prespiracular slit very slender; hindwing hidden under forewing at 3rd or 4th abdominal segment; prothoracic leg reaching 2/3 of the length to apex of wing, femur slender; mesothoracic leg extending to or before tip of maxilla; metathoracic leg short exposed beyond tip of maxilla; abdominal segments smooth; 2nd-3rd abdominal spiraculae partly visible and 8th one degenerate; lateral and dorsal grooves never present; cremaster relatively large, prominent, heavily rugous, with a pair of small spines at extremity and in some species with some weak and short straight or hooked setae.

Chaetotaxy of thorax and abdomen. Each thorax bearing D1, D2 and SD1. Abdomen: 1st segment possessing D1, 2nd-3rd segments D1, D2 and SD1, 4th segment D1, D2, SD1 and L1, 5th-7th segments D1, D2, SD1, L1, L2, SL1 and SV1, 8th segment D1, D2, SD1, L1, L2, SL1, SV1 and SV2, 9th segment D1, D2, L1 and SL1.

### *A. pyramidea* (Linnaeus) (Fig. 1)

Boby length, male about 23.6 mm (20.5-25.8 mm), female about 23.5 mm (21.3-24.8 mm).

Width, male about 7.7 mm (7.2–8.1 mm), female about 7.9 mm (7.2–8.4 mm). Scar of larval horn often present on dorso-meson of A8. Cremaster long conical, usually with one pair of horn-like and pointed spines, and two pairs of setae, but these setae sometimes missing.

Material examined: 7 males and 6 females, reared on *Taraxacum longependiculatum* Nakai, from eggs laid by females captured at Takayama-city, Gifu Pref., 9. X. 1988, pupated in early April 1989.

***A. monolitha*** Guenée (Fig. 2)

Body length, male about 24.2 mm (22.5–27.7 mm), female about 25.4 mm (24.0–28.9 mm). Width, male about 8.8 mm (8.0–9.3 mm), female about 9.0 mm (8.0–10.2 mm). Scar of larval horn often present on dorso-meson of A8 (Table 1). Cremaster long conical with one pair of small horn-like and pointed spines and two pairs of setae but some or all of them sometimes lacking (Table 2). I could not find any differences from *A. pyramidea*.

Material examined: 22 males and 18 females, reared from larvae feeding on *Quercus glauca* Thunb. and *Q. variabilis* Bl., at Gifu-city, Gifu Pref., in late April to early May 1989–1991, pupated in the middle of May to early June 1989–1991.

***A. livida*** ([Denis & Schiffermüller]) (Fig. 3)

Body length, male about 21.2 mm (19.4–23.1 mm), female about 21.4 mm (20.0–23.2 mm). Width, male about 7.4 mm (7.0–7.8 mm), female about 7.6 mm (7.0–8.0 mm). Thorax with many wrinkles. Cremaster broadly rounded with longitudinal carinae, triangle in lateral view with one pair of long and stout, widely spread spines and three pairs of hooked setae. The long spines are clearly different points from other species

Material examined: 9 males and 6 females, reared on *Taraxacum longependiculatum* Nakai from eggs laid by females captured at Gifu-city, Gifu Pref., 28. X. 1987, pupated in early and middle of May 1988.

***A. tripartita*** Butler (Fig. 4)

Body length, male about 21.2 mm, female about 23.2 mm (22.6–24.2 mm). Width, male

Table 1. The number of pupae with (+) and without (–) scar of larval horn in *A. pyramidea* and *A. monolitha*.

<i>A. pyramidea</i>				<i>A. monolitha</i>			
♂		♀		♂		♀	
+	–	+	–	+	–	+	–
3	4	3	3	6	13	3	16

Table 2. Variations of setae on the cremaster of *A. monolitha* pupa.

	All lost	Remaining number			Not lacking
	0	1	2	3	4
Male	12	3	3	2	0
Female	10	3	3	0	1

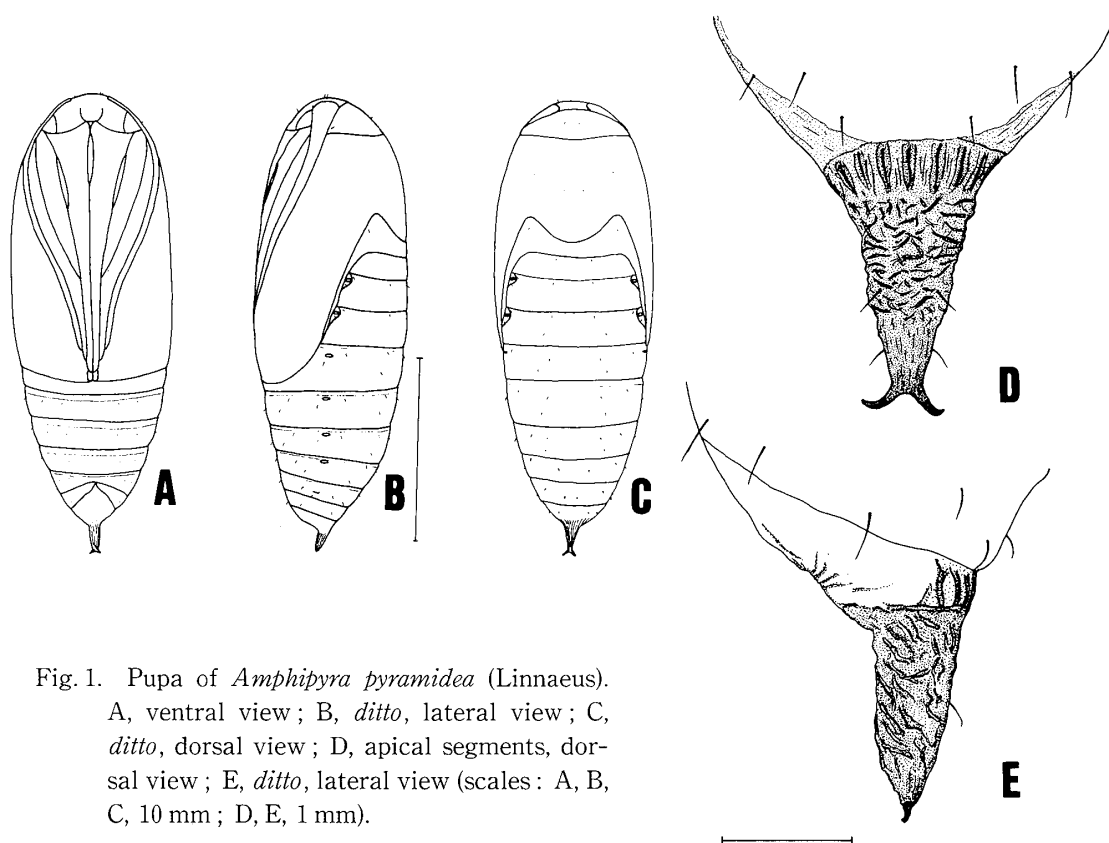


Fig. 1. Pupa of *Amphipyra pyramidea* (Linnaeus).  
A, ventral view; B, *ditto*, lateral view; C, *ditto*, dorsal view; D, apical segments, dorsal view; E, *ditto*, lateral view (scales: A, B, C, 10 mm; D, E, 1 mm).

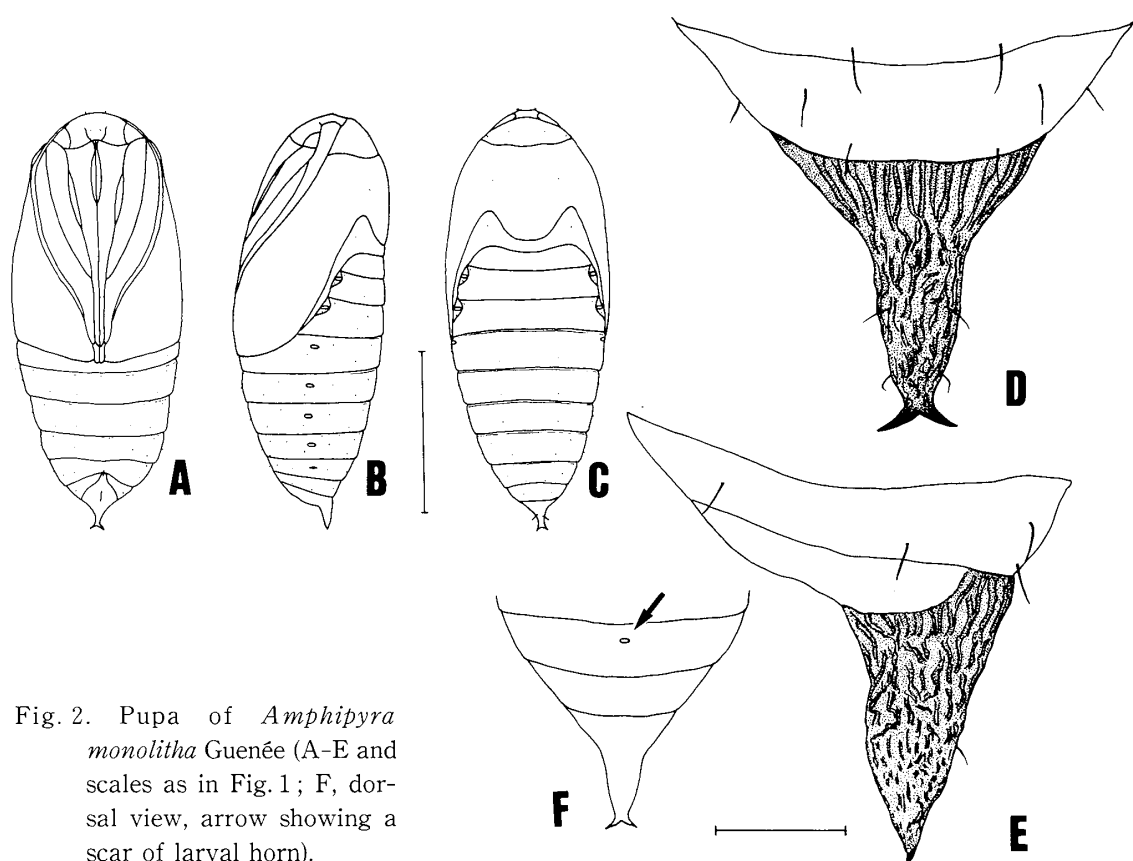


Fig. 2. Pupa of *Amphipyra monolitha* Guenée (A-E and scales as in Fig. 1; F, dorsal view, arrow showing a scar of larval horn).

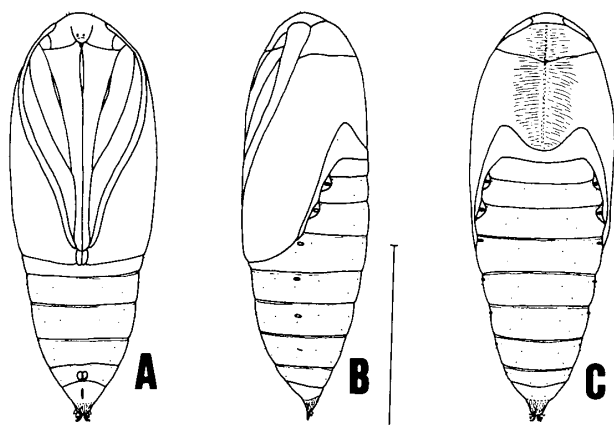


Fig. 3. Pupa of *Amphipyra livida* ([Denis & Schiffermüller]) (A-E and scales as in Fig. 1).

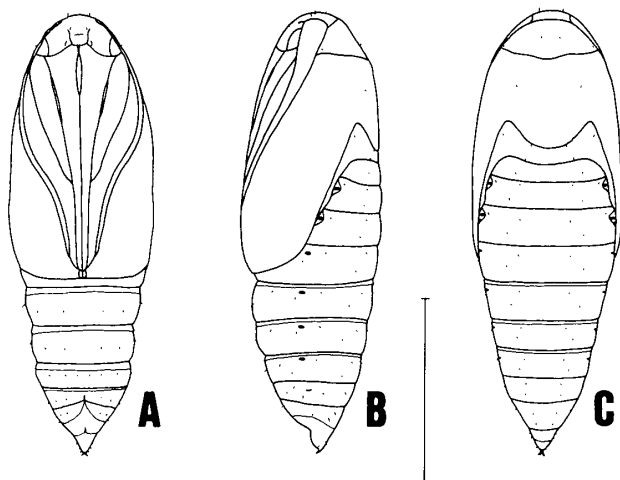
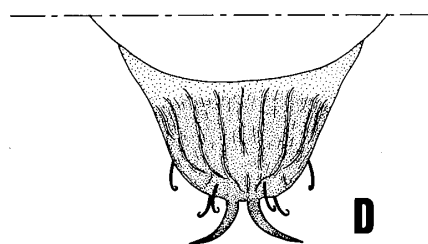
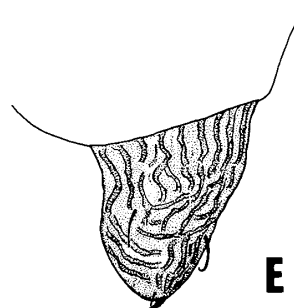
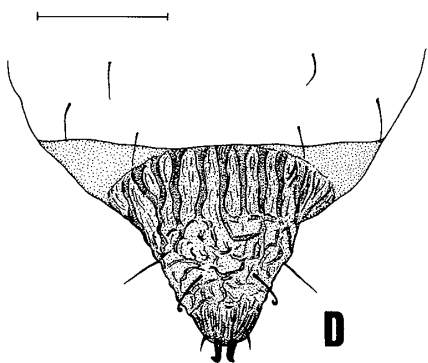


Fig. 4. Pupa of *Amphipyra tripartita* Butler (A-E and scales as in Fig. 1).



about 7.8 mm, female about 8.2 mm (8.0-8.4 mm). Cremaster roundly narrowish, a little swollen in lateral view, with one pair of small spines protruded in parallel with curved apex, two pairs of needle-like and one pair of hooked setae, caudal ones short and fatty.

Material examined: 1 male and 5 females, reared on *Quercus glauca* Thunb. from eggs laid by females captured at Miyama-cho, Gifu Pref., 16. IX. 1989, pupated in early May 1990.

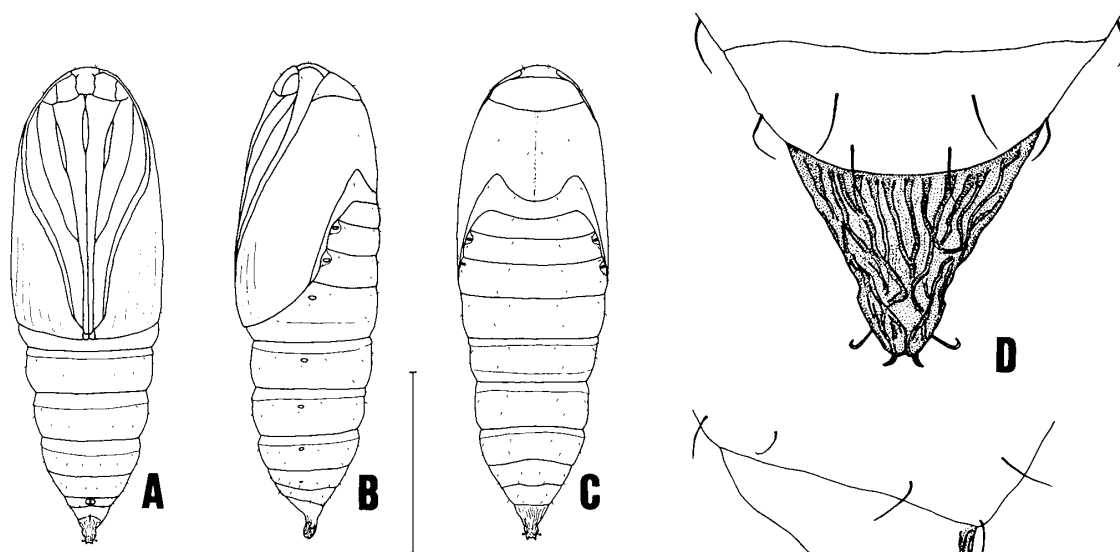


Fig. 5. Pupa of *Amphipyra schrenckii* Ménétriès (A-E and scales as in Fig. 1).

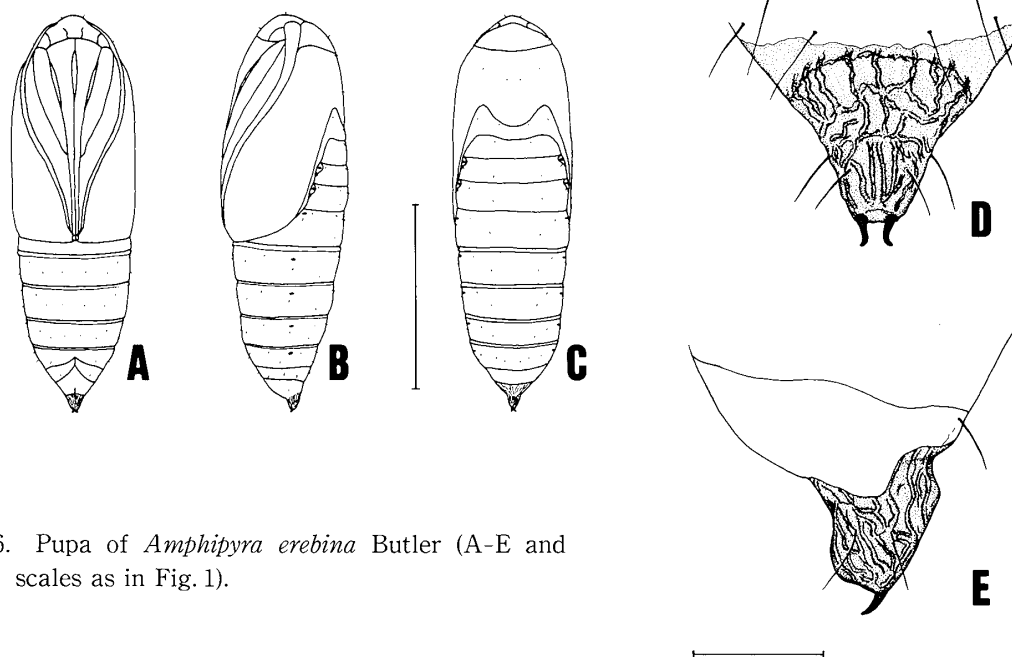


Fig. 6. Pupa of *Amphipyra erebina* Butler (A-E and scales as in Fig. 1).

**A. *schrenckii* Ménétriès (Fig. 5)**

Body length, male about 24.6 mm (23.8-25.4 mm), female about 26.0 mm. Width, male about 8.5 mm (8.4-8.6 mm), female about 8.5 mm. Cremaster large and trigonal in ventral view, protruded conically, with a pair of small obtuse spines and one pair of stout hooked setae.

Material examined: 2 males and 1 female, reared on *Prunus mume* Sieb. et Zucc. from

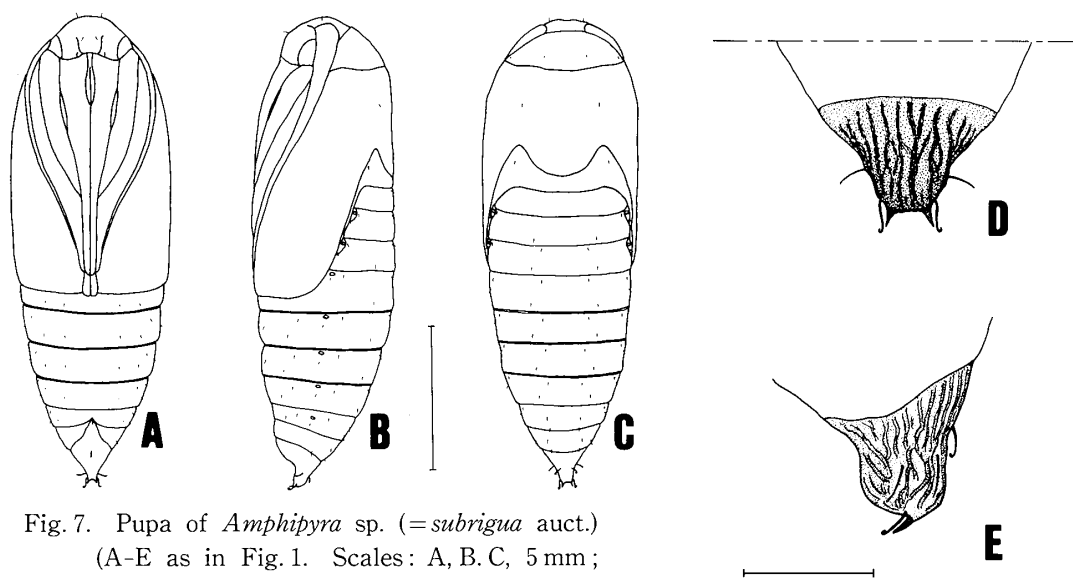


Fig. 7. Pupa of *Amphipyra* sp. (= *subrigua* auct.)  
(A-E as in Fig. 1. Scales: A, B, C, 5 mm;  
D, E, 1 mm).

eggs laid by females captured at Miyama-cho, Gifu Pref., 16. IX. 1989, pupated on 15. IV. 1990.

#### *A. erebina* Butler (Fig. 6)

Body length, male about 21.4 mm, female about 21.8 mm (21.0–22.6 mm). Width, male about 7.1 mm, female about 7.3 mm (6.9–7.7 mm). Cremaster an obtuse prominence, right triangle in ventral view, dented in dorsal and fattened in lateral views, with one pair of spines which are longer than those of *A. shrenckii* and two pairs of long straight setae.

Material examined: 1 male and 3 females, reared on *Prunus incisa* Thunb. from eggs laid by female captured at Miyama-cho, Gifu Pref., 26. VIII. 1992, pupated on 30. IV. 1993, 5, 6. V. 1993.

#### *A. sp.* (= *subrigua* auct.) (Fig. 7)

Body length, male about 16.7 mm (16.0–18.0 mm), female about 17.0 mm (16.7–17.4 mm). Width, male about 5.5 mm (5.0–6.0 mm), female about 5.9 mm (5.8–6.2 mm). Cremaster broadly rounded as in *A. livida* but little fattened in both lateral and dorsal sides, with one pair of spines and three pairs of curly hooked setae.

Material examined: 8 males and 5 females, reared from larvae feeding on *Buxus microphylla* Sieb. et Zucc., at Nakakosi, Miyama-cho, Gifu Pref., 28. IV. 1985, pupated from the beginning to the middle of May. 1985.

#### Biological notes on pupation

Generally, the species possessing cremastral spines pupate in soil, whereas the species which have cremastral hook-like setae pupate in the silken cocoon (Nakamura, 1987). It is suggested from this fact that larvae of *A. pyramidea*, *A. monolitha* and *A. erebina* pupate in soil because they do not have hooked setae on the cremaster. On the other hand, larvae of *A. livida* and *A. schrenckii* pupate in the cocoon on account of having hooked setae. In this genus, however, the cremastral setae and spines are degenerate and the relation

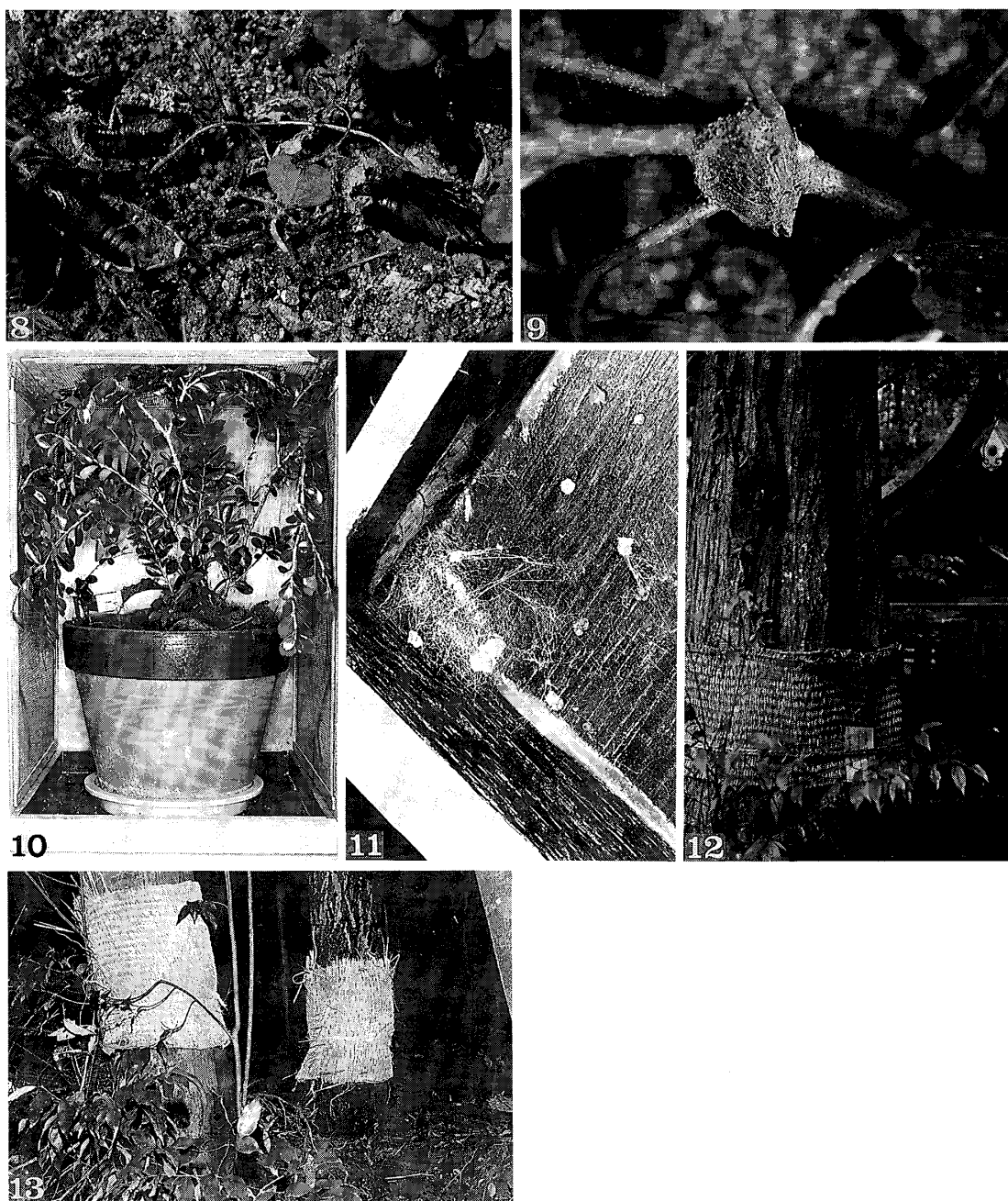


Fig. 8. Pupation in *A. livida* with the cocoon on the ground.

Fig. 9. Pupation in *A. livida* with the cocoon on the branch near the ground.

Fig. 10. Experiment box of *A. sp.* (= *subrigua* auct.) with host plant, *Buxus microphylla*.

Fig. 11. Pupation in *A. sp.* (= *subrigua* auct.) with a simple cocoon at the corner of the experiment box.

Figs 12, 13. Investigation to find pupae of *Amphipyra* species in the field.

between pupating habit and setal function of cremaster is obscure. The similar relationship was reported in Sphingidae (Nakamura, 1976). The last instar larvae of *A. pyramidea* and *A. monolitha* pupate in the thin cocoon spun between leaves (Kawada 1959; Yamamoto, 1965) and that of *A. livida* spins leaves and pupates on the ground (Yamamoto, 1965) or in soil (Yamamoto, 1987). I observed that the reared larvae of *A. livida* pupated on the ground (Fig. 8) or in the cocoon on the branch near the ground (Fig. 9), and that of

*A. sp.* (= *subrigua* auct.) pupated at the corner of the experiment box (Figs 10, 11) and in a simple cocoon on the ground. The larvae of other species made fine cocoon between folded leaves and pupated in them on the bottom of the vessel. Though I could not find *Amphipyra* pupae in the field in spite of many surveys (Figs 12, 13), it is presumed that pupae of *Amphipyra* species both with and without hook-like setae make a simple or fine cocoons on soil and nearby.

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### 摘 要

カラスヨトウ属 (*Amphipyra*) の蛹について (船越進太郎)

ヤガ科カラスヨトウ亜科カラスヨトウ属 (*Amphipyra*) の日本産7種の蛹を調べたところ、いずれもよく似るが、尾突起はそれぞれの種で特徴的な形態であった。尾突起には針状あるいは鉤状の刺毛が生じ、シマカラスヨトウ (*A. pyramidea*)、オオシマカラスヨトウ (*A. monolitha*) およびオオウスヅマカラスヨトウ (*A. erebina*) は針状の、カラスヨトウ (*A. livida*)、ツマジロカラスヨトウ (*A. schrenckii*) は鉤状の、シロスジカラスヨトウ (*A. tripartita*) とヤヒコカラスヨトウ (*A. sp.*) は両方の刺毛を有していた。飼育下での観察によればカラスヨトウは地表面や地表近くの枝の分岐点に繭を作り、ヤヒコカラスヨトウは地表面や飼育箱の片隅で簡単な繭を作って蛹化した。そのほかの種も葉を綴って繭を作ったが、同様な場所で蛹化したので、刺毛形態と蛹化場所との間には関連はないと考えられた。

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